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(S) NATIONAL RECONNAISSANCE OFFICE  
WASHINGTON, D.C.

THE NRO STAFF

14 August 1969

MEMORANDUM FOR CHAIRMAN, COMMITTEE ON IMAGERY  
REQUIREMENTS AND EXPLOITATION

SUBJECT: Projected CORONA Satisfaction of USIB Requirements,  
FY 1970 and 1971

- REFERENCES: (a) USIB D-41.15/79 (COMOR D-48/115, dated  
16 Sept 1966), approved 8 Nov 1966
- (b) USIB D-46.4/27 (COMIREX D-13.16/3, dated  
4 Feb 1969), approved 27 Feb 1969
- (c) USIB D-46.9/19 (COMIREX D-16.2/1, dated  
11 Apr 1969), noted 23 Apr 1969

Projections of expected CORONA satisfaction of USIB requirements for FY 1970 and FY 1971 are presented and explained in the attachment to this memorandum. It is the result of blending the findings of studies independently performed by CIA/OSP and in-house by the NRO Staff.

This analysis is operationally oriented and shows the trade-offs available by flying STB or UTB at varying altitudes under three operational philosophies. The subject of reduced resolution with increasing altitude is absent from this paper, since its effect on intelligence content is best answered by those representing the consumers who exploit CORONA photography.

NRO review(s) completed.

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Attachment  
Projected CORONA Satisfaction Levels

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# PROJECTED CORONA SATISFACTION LEVELS FIVE MISSIONS PER YEAR

## Problem.

This analysis addresses the problem of satisfying USIB requirements for CORONA under the dual handicaps of a launch rate reduction to five per year during fiscal years 1970 and 1971 and the possibility that ultra-thin-base (UTB) film will not become flight-qualified in the CORONA payload.

## Background.

The expected satisfaction levels generated by this analysis are an amalgamation of the results of three separate studies, two performed by CIA/OSP and the third by NRO/SOC.

The first CIA/OSP study is an October 1968 computer simulation wherein climatology was applied to each access of the search areas to provide an expected search satisfaction level for any desired number of days on orbit per period without regard to the amount of film available.

The second CIA/OSP study is a July 1969 parametric analysis of CORONA history which, under varying conditions of film type and perigee altitude, presents the expected semiannual search satisfaction in terms of the portion of each year's film which is expended against that requirement.

The NRO/SOC study was presented to the DNRO in late May 1969 and is a mission-oriented approach, also based on CORONA history, in which each of the remaining CORONA payloads was flight-planned under various flight conditions in as real-life a manner as possible. Seasonally adjusted climatology in terms of probability of 90-100 percent cloud-free CORONA photography was employed, as was the inter-reaction of the five basic CORONA requirements in their demand for each mission's film.

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Each of the studies provide some measure of expected CORONA performance not available from the other two, yet each generally agree on the semiannual search satisfaction level which can be expected. Thus, the following presents the combined data and shows the trade-offs between the various requirements which are available during a five-mission year.

#### Caution.

A note of caution is required in interpreting the average semi-annual search satisfaction projections presented here. They are based on as many as nine years of daily weather observations in the Communist countries, but this is no guarantee that a mission launched this November will actually encounter the weather which history says should be expected. The semiannual search satisfactions are expressed in terms of annual averages and the tolerance limits or confidence level attendant to those satisfactions are about plus or minus 7 percent, mainly due to the vagaries of weather. For example, a prediction of 67 percent average semiannual search satisfaction for UTB missions flown at 85-nautical-mile perigees means that some average satisfaction within the range of 60 percent to 74 percent can confidently be expected.

Additionally, CORONA history also demonstrates that the monthly satisfaction levels for semiannual search will fluctuate within about plus or minus 15 percent of the average level for that year.

Unusual and unpredictable requirements such as those levied against Mission 1051 in May of this year will also significantly affect satisfaction levels projected into the future.

#### Expected Satisfaction.

The USIB requirements for CORONA are well established and have been recently reviewed and confirmed. The difficulty of satisfying the five specific CORONA requirements is reviewed in the following paragraphs, being treated in light of the present stage of the 6-year-old CORONA program. They are considered in the order of increasing difficulty to satisfy.

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a. Mapping, Charting and Geodesy.

Over 75 percent of the coverage requirement for the primary instrument has been satisfied and the remainder is in climatologically unfavorable areas. MC&G photography will, under any launch rate or altitude condition, be attempted on every occasion that favorable weather is forecasted, and the small amount of film thus expended will have no appreciable effect on the satisfaction levels of the other CORONA requirements.

b. High-Priority Areas for One-Time Search and Surveillance.

Film expenditures against the high-priority areas (HPA's) and targets assigned by the ICRS on a mission-by-mission basis have, over the past 2 years, averaged 20 percent of each mission's film. Projections of CORONA satisfaction recently presented to the COMIREX, the DNRO, and the Executive Committee have employed the basic assumption that the current intelligence and special search and surveillance needs expressed by each mission's high-priority list will continue to be an important part of CORONA tasking and, thus, in the nominal cases presented, 20 percent of each future mission's film has been reserved for this purpose.

A trade-off is available between HPA usage and the most difficult to satisfy requirement for semiannual search. If no film were allocated for HPA's and the 20 percent thus "saved" were expended against the semiannual search areas, an increase of about 5 percent in average semiannual search satisfaction could be expected. This holds true for any combination of UTB/STB films at perigee altitudes from 85 to 100 nautical miles in a five-mission year. An opposite trade-off, that of increasing the emphasis on HPA's to 40 percent of each mission's film, would result in lowering expected semiannual search satisfaction by about 10 percent.

c. Outside-the-Bloc Annual Search.

The outside-the-Bloc requirement for 2.5 million square nautical miles of cloud-free photography annually can be met with UTB film at any perigee under consideration and with STB film aboard a 100-nautical-mile mission.

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A trade-off is available here also in that the outside-the-Bloc coverage can be suppressed in order to provide an increase of about 6 percent in average semiannual search satisfaction.

STB film at 85 nautical miles will provide only about one million square nautical miles of cloud-free coverage outside-the-Bloc if semiannual search coverage is to be protected, and that can only be obtained during the summer mission(s) when in-Bloc climatology is poor and relatively few good weather accesses are available in the search areas.

d. In-Bloc Annual Search.

The annual search requirement of 75 percent per year can be satisfied under any film and perigee combination considered herein. The extreme measure of completely ignoring the annual search requirement and applying that film to semiannual search would only improve its satisfaction by about 5 or 6 percent.

e. In-Bloc Semiannual Search.

Semiannual search is the CORONA requirement most difficult to satisfy and is also the most sensitive to a reduction in gross ground coverage capability--this capability is directly influenced by a reduced launch rate, the UTB film question, and perigee altitude.

Historically, CORONA satisfaction of this requirement has been in the range between 60 and 70 percent more often than it has been at any level outside that band. The average satisfaction in FY 68 was 64 percent and in FY 69 it was 71 percent. Two months during the past two years saw the 80 percent requirement level met or surpassed and both were directly attributable to the serendipitous Mission 1106 in February 1969.

The semiannual search satisfaction which can be expected from a five-mission year will vary with the operational philosophy employed to best satisfy the basic USIB requirements for CORONA and the mission-to-mission guidance which is received. Previous projections were based on the conditions that:

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- o Twenty percent of film reserved for HPA's.
- o Annual search would be protected.
- o A reduction in outside-the-Bloc search would be accepted to protect semiannual search for the lower altitude STB cases.
- o Outside-the-Bloc search could be completely satisfied without serious effect on semiannual search for all UTB cases and STB at 100 nautical miles.
- o MC&G usage was generally protected since its effect on semiannual search was negligible.

These conditions are basically a "business as usual" approach and provided a range of average semiannual search satisfaction which varied from 53 percent to 67 percent for STB missions with perigee altitudes from 85 to 100 nautical miles. With UTB these values varied from 67 percent to 77 percent.

This paper also provides a range of expected semiannual search satisfaction levels for the unlikely, but illustrative, situation where all other requirements are ignored in order to maximize semiannual search. These values range from 62 percent to 82 percent for STB and from 82 percent to 91 percent for UTB at the perigees considered. A matrix of all expected satisfaction levels is shown on the last page for 24 different cases in which perigee altitude, film type, and operational philosophy vary. Eight of the cases show the effects of doubling HPA usage and concomitantly give an answer to the old question of "How much do HPA's hurt search?"

The numbers shown are valid for any isolated year, such as FY 1971. The semiannual search satisfaction to be expected for FY 1970 should be about 2 percent less because of beginning the fiscal year at the comparatively low level of 57 percent.

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Summary.

All five of the basic CORONA requirements must be considered with equal weight, since the USIB requirements statements do not assign any more emphasis to one than the others.

Three basic missions will provide satisfaction levels which have been historically acceptable: STB at 100 nautical miles perigee and UTB at either 85 or 90 miles. These three can be expected to provide 67 percent to 71 percent average semiannual search satisfaction while meeting the letter of the other four requirements.

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PROJECTED CORONA SATISFACTION LEVELS  
FIVE MISSIONS PER YEAR

OPERATIONAL PARAMETERS			ANNUAL AVERAGE SATISFACTION			MC&G Usage (Film)	HPA Usage (% of Film)
Perigee Altitude (n.m.)	Film Type	Method	Semiannual Search (%)	Annual Search (%)	Outside Bloc (10 <sup>6</sup> n.m. <sup>2</sup> )		
85	STB	A	53	75	1.0	Nominal	20%
		B	62	0	0	0	0
		C	43	75	2.5	Nominal	40%
90	STB	A	58	75	1.5	Nominal	20%
		B	69	0	0	0	0
		C	49	75	2.5	Nominal	40%
95	STB	A	62	75	2.0	Nominal	20%
		B	75	0	0	0	0
		C	54	75	2.5	Nominal	40%
100	STB	A	67	75	2.5	Nominal	20%
		B	82	0	0	0	0
		C	59	75	2.5	Nominal	40%
85	UTB	A	67	75	2.5	Nominal	20%
		B	82	0	0	0	0
		C	59	75	2.5	Nominal	40%
90	UTB	A	71	75	2.5	Nominal	20%
		B	85	0	0	0	0
		C	62	75	2.5	Nominal	40%
95	UTB	A	74	75	2.5	Nominal	20%
		B	88	0	0	0	0
		C	65	75	2.5	Nominal	40%
100	UTB	A	77	75	2.5	Nominal	20%
		B	91	0	0	0	0
		C	68	75	2.5	Nominal	40%

A. Normal mission philosophy with 20 percent of each mission's film expended for HPA's.

B. Maximized semiannual search with no film spent for any other purpose.

C. Increased HPA emphasis to 40 percent of each mission's film; all other requirements satisfied except semiannual search.

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